FIG. 1

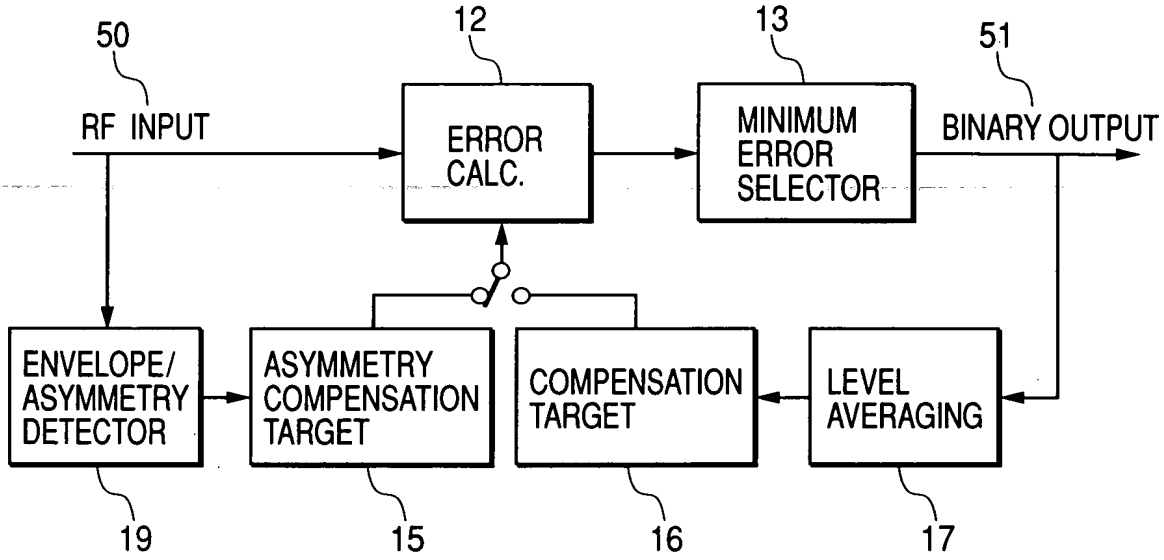

50
RF INPUT
12
ERROR CALC.
13
MINIMUM ERROR SELECTOR
51
BINARY OUTPUT
ENVELOPE/ ASYMMETRY DETECTOR
ASYMMETRY COMPENSATION TARGET
COMPENSATION TARGET
LEVEL AVERAGING
19
15
16
17

FIG. 2

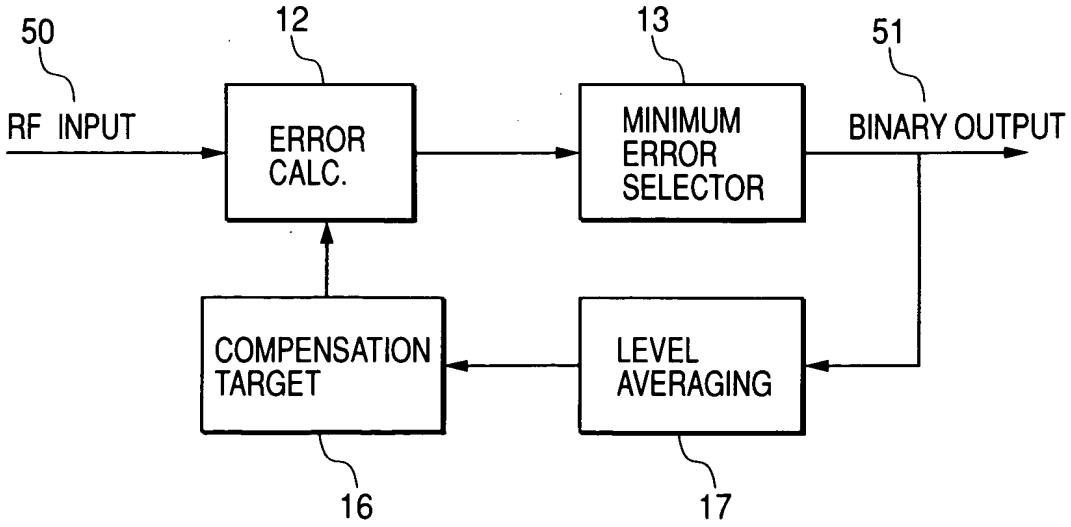

50
RF INPUT
12
ERROR CALC.
13
MINIMUM ERROR SELECTOR
51
BINARY OUTPUT
COMPENSATION TARGET
LEVEL AVERAGING
16
17

FIG. 3

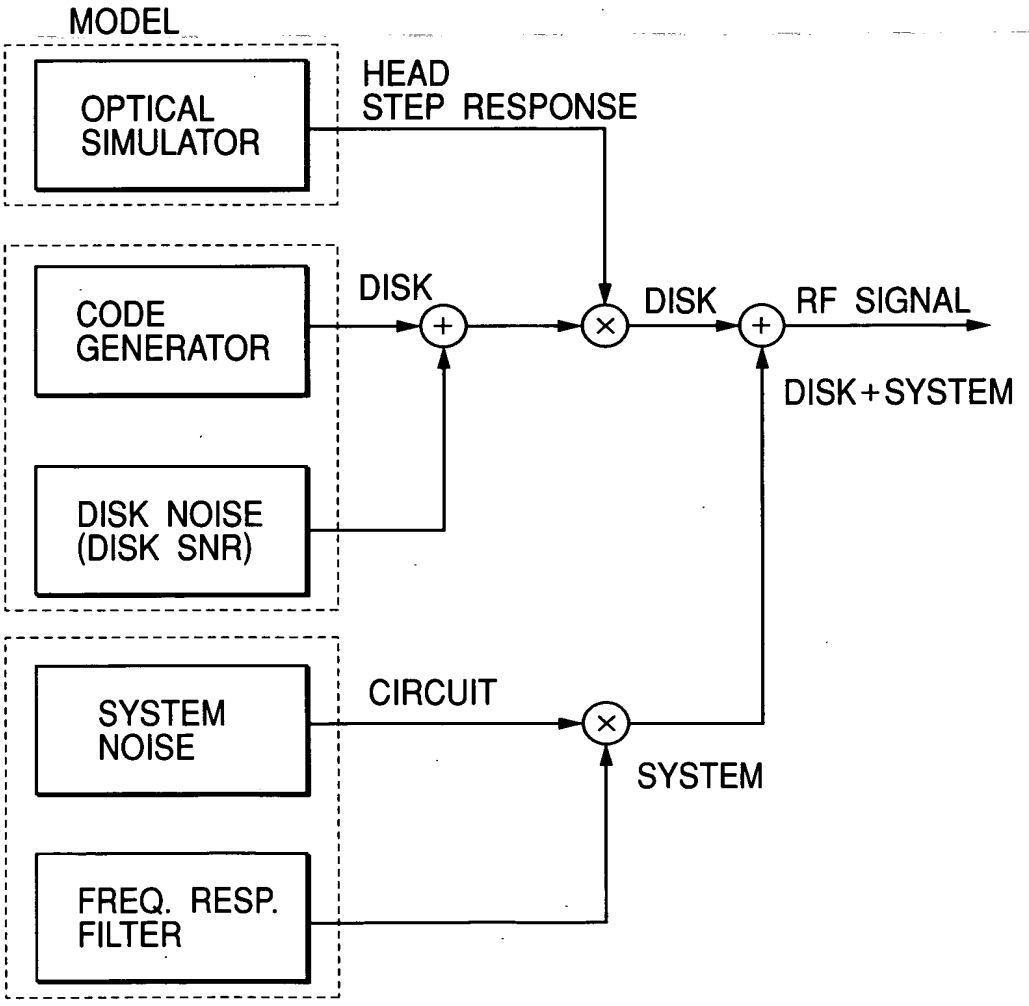
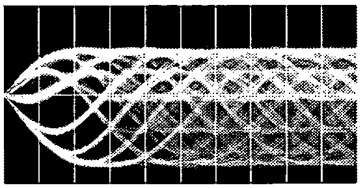
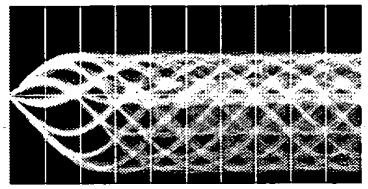
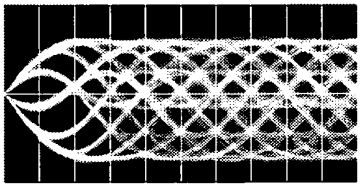
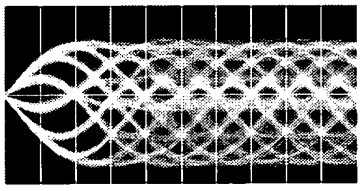
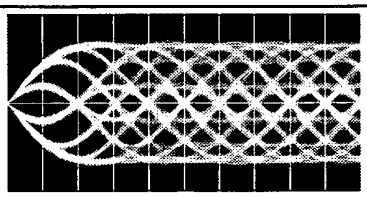
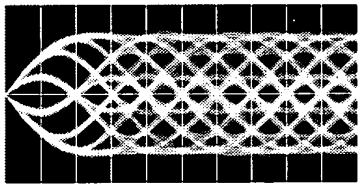
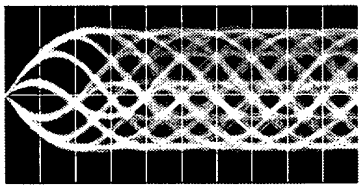
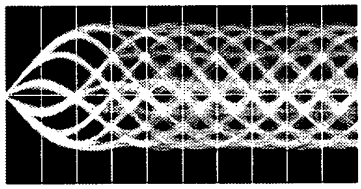
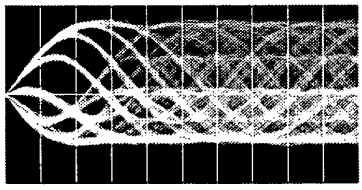
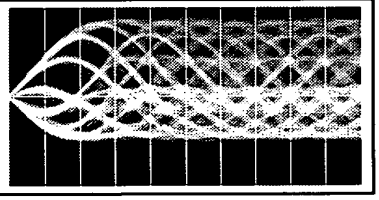

MODEL
OPTICAL SIMULATOR
HEAD STEP RESPONSE
CODE GENERATOR
DISK
DISK
RF SIGNAL
DISK+SYSTEM
DISK NOISE (DISK SNR)
SYSTEM NOISE
CIRCUIT
SYSTEM
FREQ. RESP. FILTER

FIG. 4

SIGNALS OF RLL(1,7)

Δ MARK	ASYMMETRY	HPF SIGNAL	DFB SIGNAL
−0.8Tw	−20%		
−0.4Tw	−10%		
±0Tw	0%		
+0.4Tw	+10%		
+0.8Tw	+20%		

SIMULATION CONDITION
WAVELENGTH = 405nm
NUMERICAL APERTURE = 0.85
Tw = 75nm
MODULATION CODE = RLL(1,7)
PRCLASS = PR(1,2,2,1)
EQ = 11TAP(OPTIMIZED BY LSE METHOD)

FIG. 5

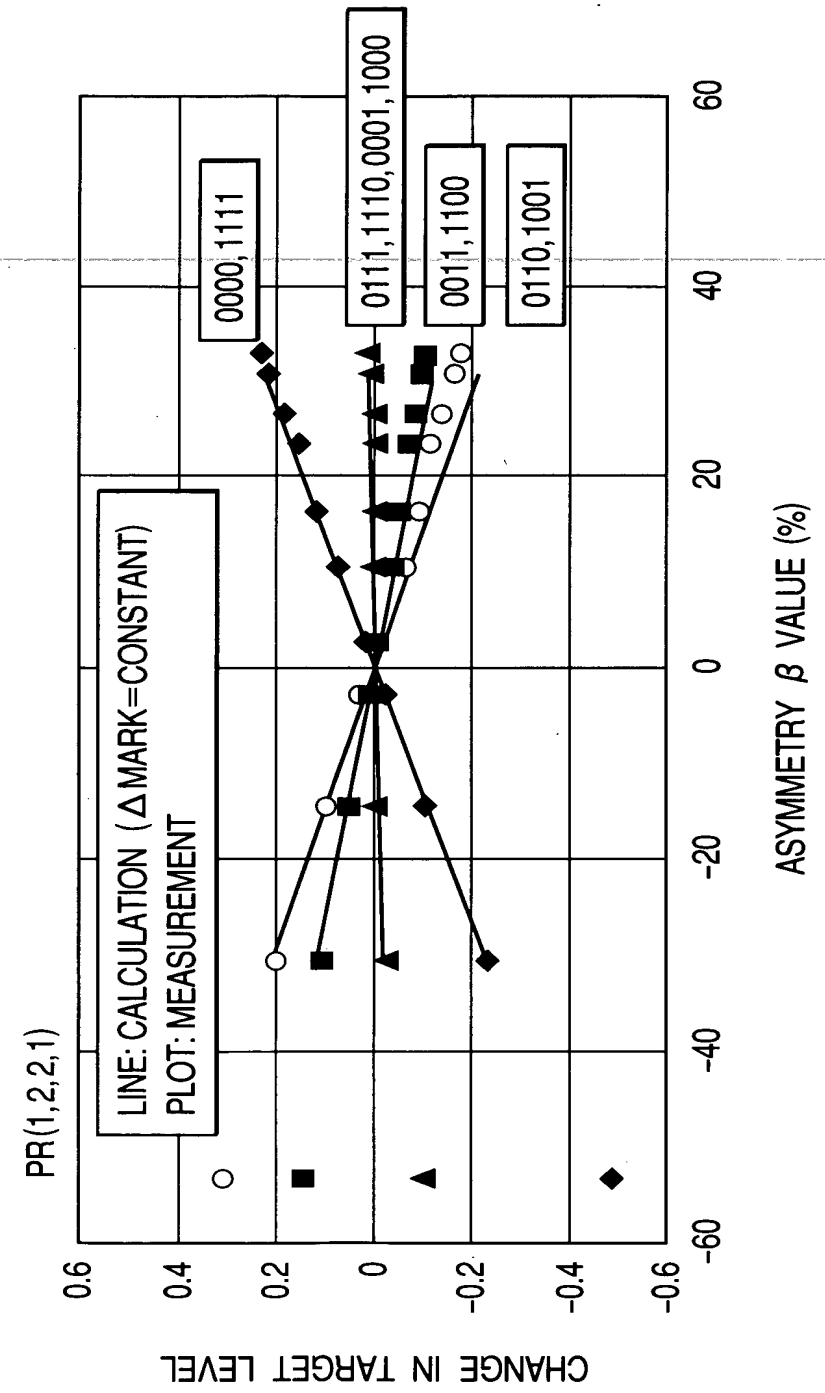
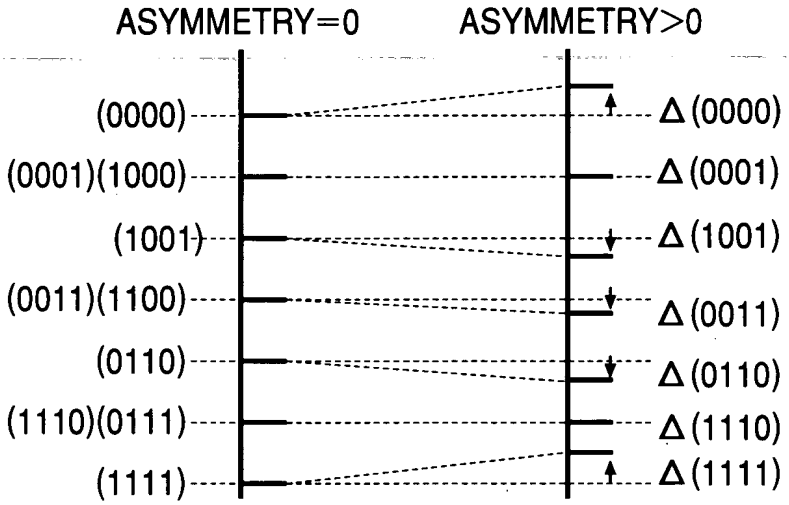

0000,1111
0111,1110,0001,1000
0011,1100
0110,1001
LINE: CALCULATION (Δ MARK=CONSTANT)
PLOT: MEASUREMENT
PR(1,2,2,1)
CHANGE IN TARGET LEVEL
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
60
40
20
0
-20
-40
-60
ASYMMETRY β VALUE (%)

FIG. 6



RULE OF ASYMMETRY FOR THE BLUE LD DISKS

(1) FOLLOWING FOUR LEVELS CAN BE REPRESENTED ALL 10 BIT ARRAYS

$\Delta 4=(\Delta(0000)+\Delta(1111))/2$
$\Delta 3=(\Delta(0001)+\Delta(1000)+\Delta(1110)+\Delta(0111))/4$
$\Delta 2=(\Delta(1001)+\Delta(0110))/2$
$\Delta E=(\Delta(0011)+\Delta(1100))/2$

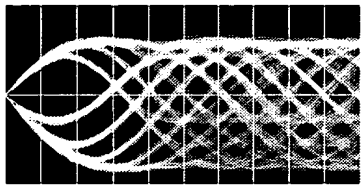
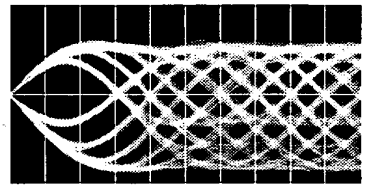
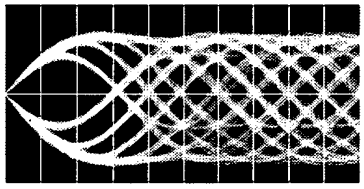
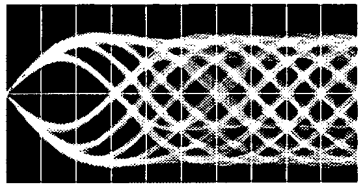
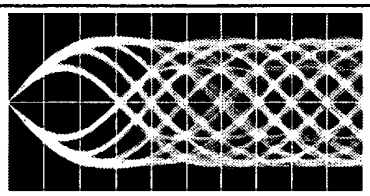
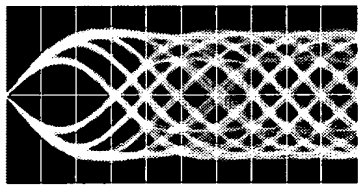
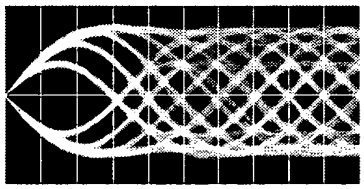
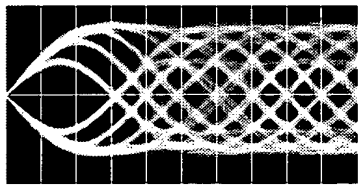
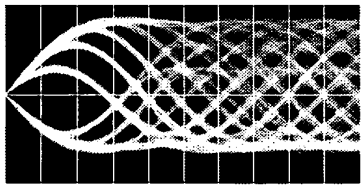
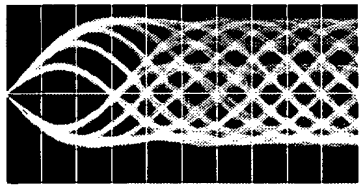
(2) FOLLOWING PROPORTIONAL RELATIONSHIP IS FOUND

$\Delta 4: \Delta 3: \Delta 2: \Delta E=1:0.05:-0.91:0.52$

SUMMARY:
BY USING THE ENVELOPE LEVELS OF READOUT SIGNAL ($\Delta 4$) OR ASYMMETRY, THE OPTIMUM TARGET LEVELS FOR PRML DETECTION CAN BE DEFINED

FIG. 7

SIGNALS OF RLL(2,10)

ΔMARK	ASYMMETRY	HPF SIGNAL	DFB SIGNAL
−0.8Tw	−14%		
−0.4Tw	−7%		
±0Tw	0%		
+0.4Tw	+7%		
+0.8Tw	+14%		

SIMULATION CONDITION
WAVELENGTH = 650nm
NUMERICAL APERTURE = 0.60
Tw = 133nm
MODULATION CODE = RLL(2,7)
PRCLASS = PR(3,4,4,3)
EQ = 11TAP(OPTIMIZED BY LSE METHOD)

FIG. 8

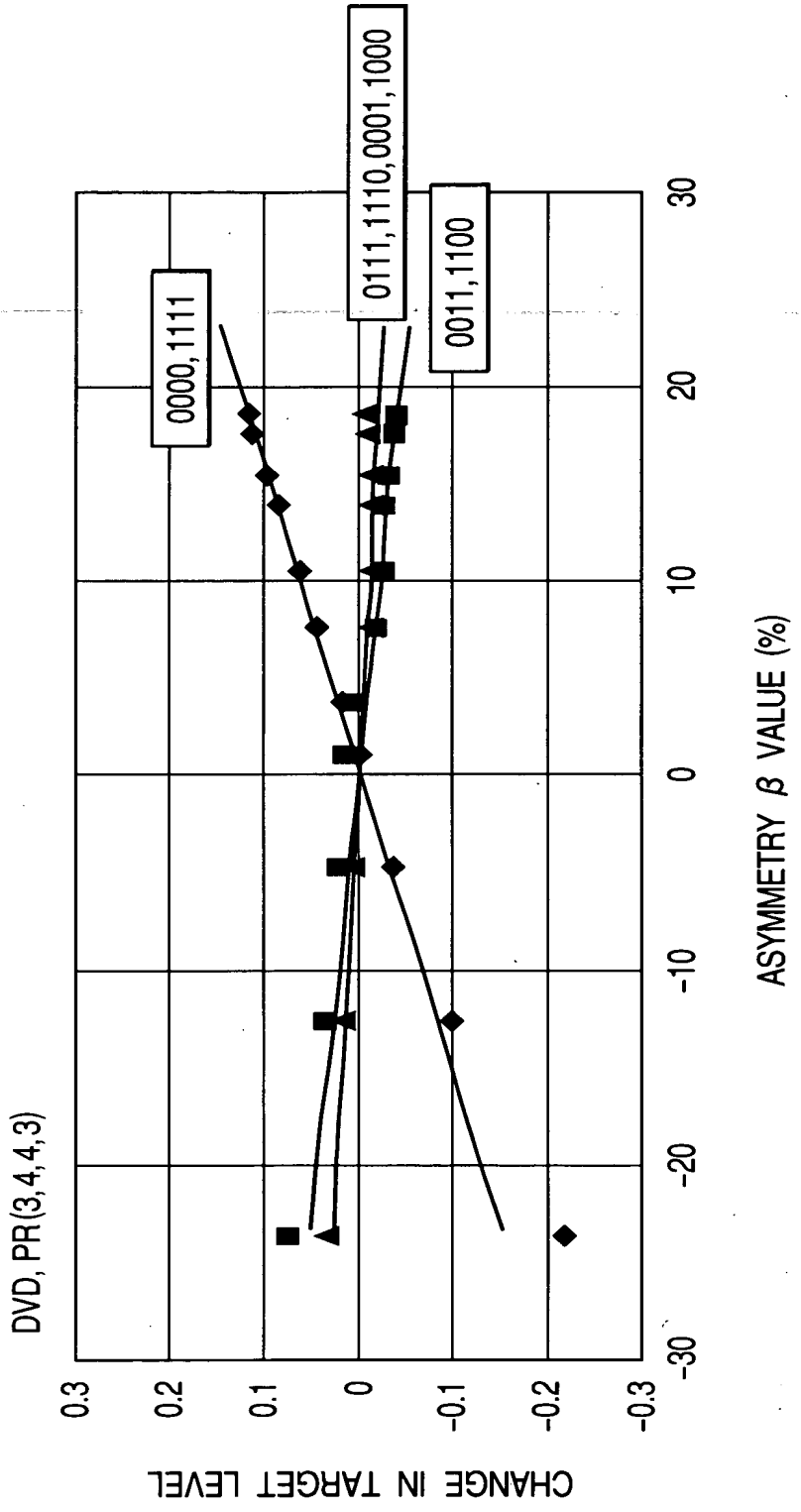
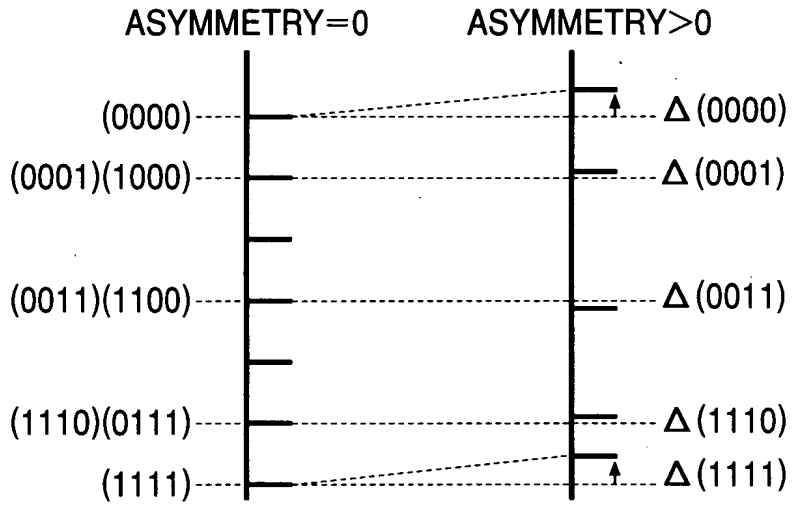

0000,1111
0111,1110,0001,1000
0011,1100
DVD, PR(3,4,4,3)
CHANGE IN TARGET LEVEL
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
30
20
10
0
-10
-20
-30
ASYMMETRY β VALUE (%)

FIG. 9



RULE OF ASYMMETRY FOR DVD

(1) FOLLOWING THREE LEVELS CAN BE REPRESENTED ALL 8 BIT ARRAYS

$\Delta 4=(\Delta(0000)+\Delta(1111))/2$

$\Delta 3=(\Delta(0001)+\Delta(1000)+\Delta(1110)+\Delta(0111))/4$

$\Delta E=(\Delta(0011)+\Delta(1100))/2$

(2) FOLLOWING PROPORTIONAL RELATIONSHIP IS FOUND

$\Delta 4: \Delta 3: \Delta E=1:-0.15:-0.31$

FIG. 10

MODULATION CODE	PR CLASS (*)	HPF ONLY (**)	DFB (DUTY FEEDBACK) (**) SLICE CONTROL
RLL (1,7) BD	PR (1,2,2,1)	Δ4: Δ3: Δ2: ΔE= 1:0.05:−0.91:0.52 Δ4=0.009α OR Δ4=0.007β	Δ4: Δ3: Δ2: ΔE= 1:0.36:−0.29:−0.04 Δ4=0.015α OR Δ4=0.011β
RLL (2,10) DVD	PR (3,4,4,3)	Δ4: Δ3: ΔE= 1:−0.15:−0.31 Δ4=0.0087α OR Δ4=0.0064β	Δ4: Δ3: ΔE= 1:0.11:−0.01 Δ4=0.010α OR Δ4=0.008β

(*) PR TARGET LEVEL NORMALIZATION
TARGET LEVELS ARE NORMALIZED FOR ±1
(TARGET LEVEL OF (0000) AND (1111) ARE ±1)

(**) LEVEL DEFINITIONS

$$\Delta 4=(\Delta(0000)+\Delta(1111))/2$$
$$\Delta 3=(\Delta(0001)+\Delta(1000)+\Delta(1110)+\Delta(0111))/4$$
$$\Delta 2=(\Delta(1001)+\Delta(0110))/2$$
$$\Delta E=(\Delta(0011)+\Delta(1100))/2$$

WHERE,
Δ4 CAN BE MEASURED BY ENVELOPE DETECTION CIRCUIT, OR CAN BE CALCULATED FROM α (SIGNAL ASYMMETRY IN %) AND β (β VALUE IN %)

FIG. 11

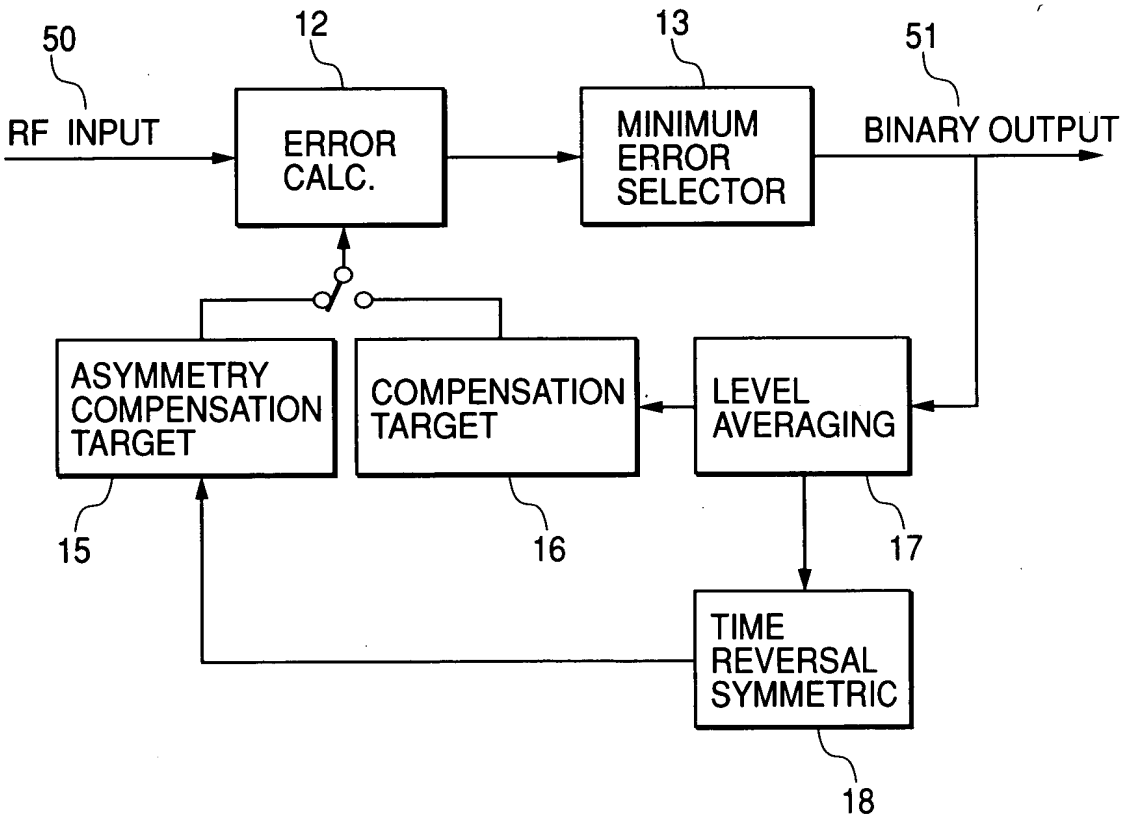

50
RF INPUT
12
ERROR CALC.
13
MINIMUM ERROR SELECTOR
51
BINARY OUTPUT
ASYMMETRY COMPENSATION TARGET
COMPENSATION TARGET
LEVEL AVERAGING
15
16
17
TIME REVERSAL SYMMETRIC
18

FIG. 12A

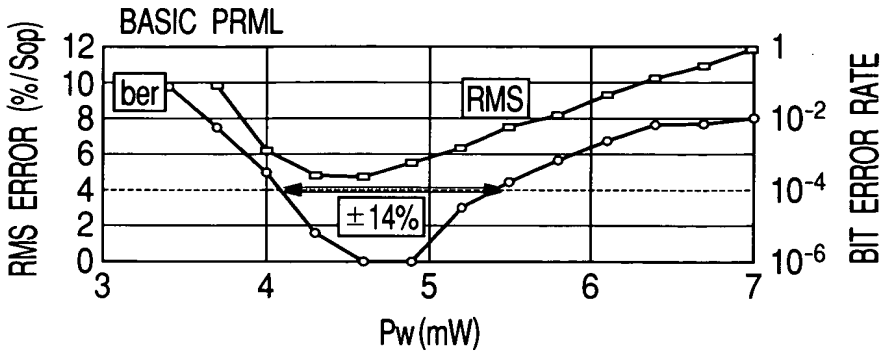


FIG. 12B

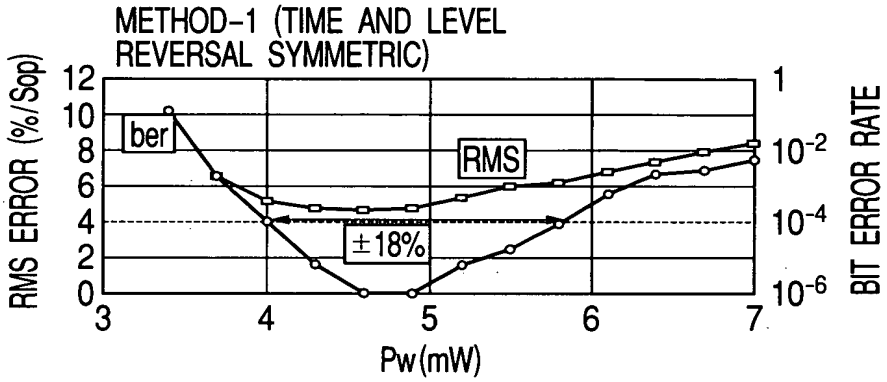


FIG. 12C

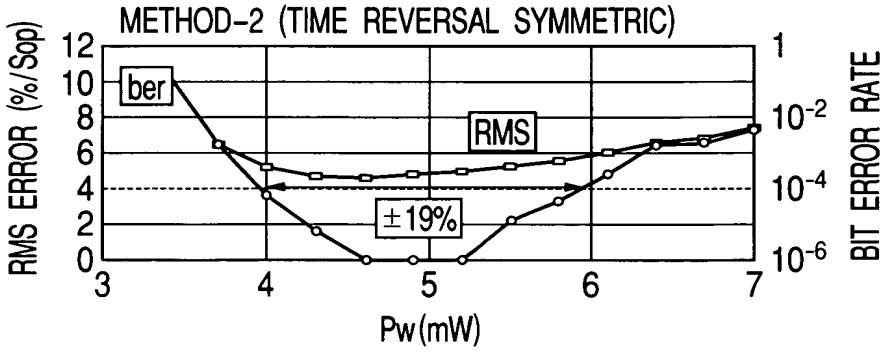


FIG. 12D

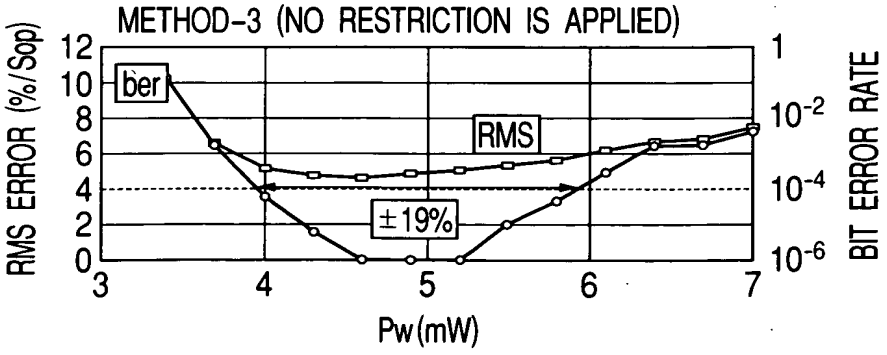


FIG. 13A

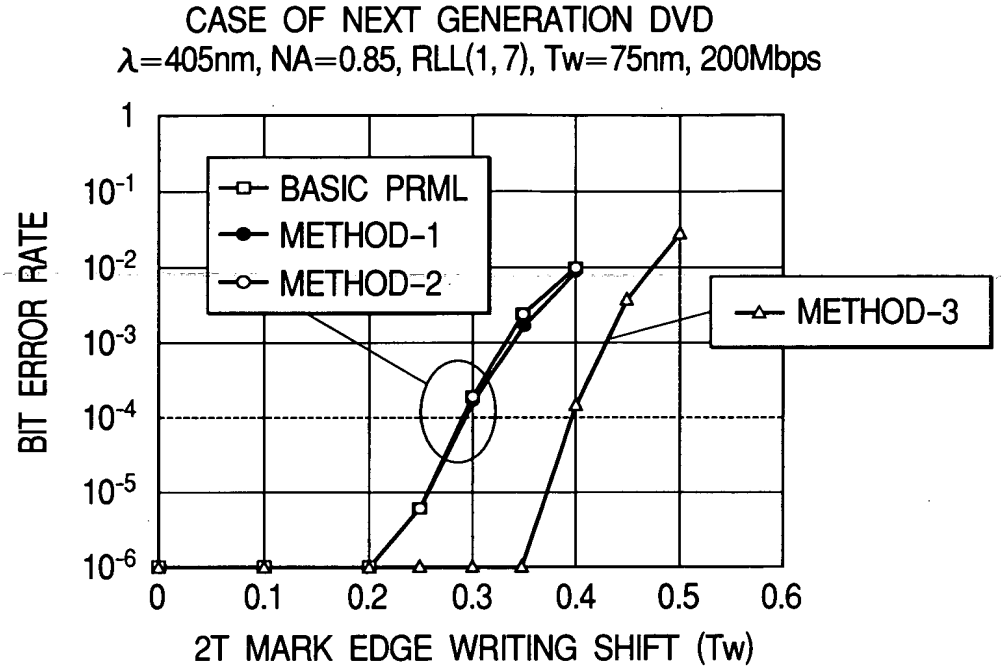


FIG. 13B

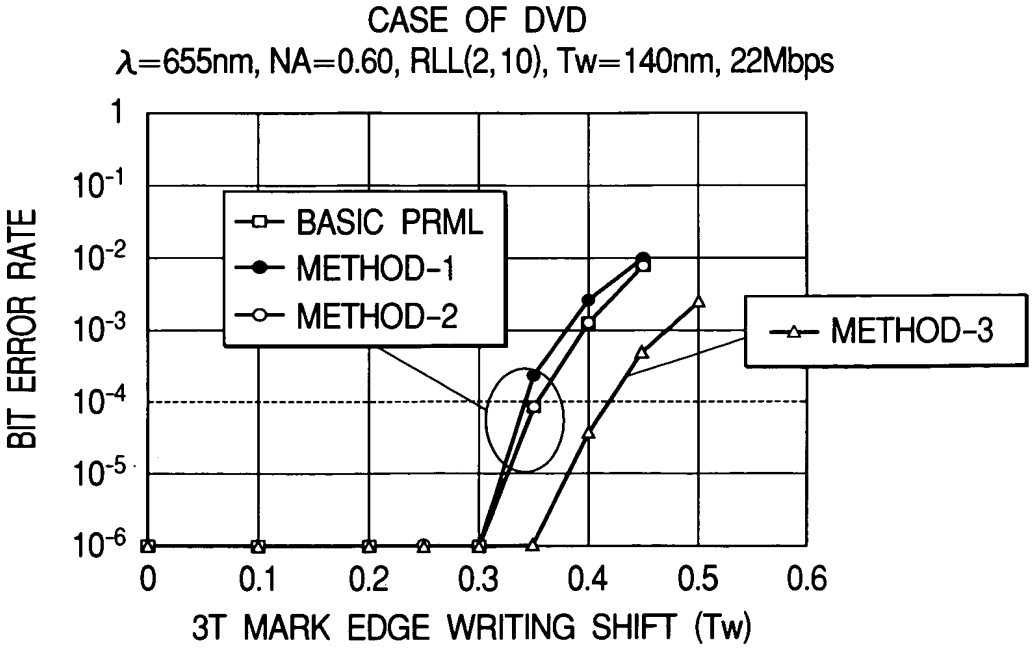


FIG. 14

CONTENTS	BASIC PRML	ADAPTIVE PRML	OUR INVENTION
TARGET LEVELS	FIXED	ADAPTIVE TO READOUT SIGNAL	ADAPTIVE TO ASYMMETRY
ASYMMETRY COMPENSATION	×	○	○
WRITE CONDITION ADJUSTMENT	×	△	○
MEDIA INTERCHANGEABILITY	△	×	○

FIG. 15A

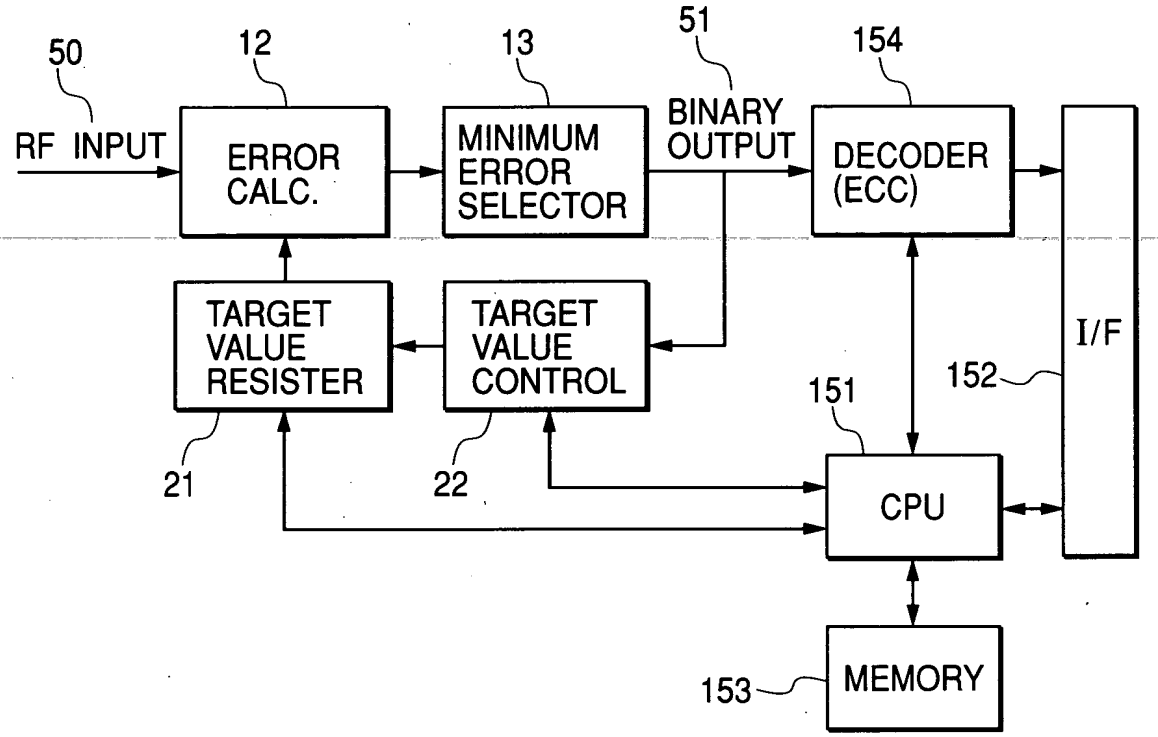
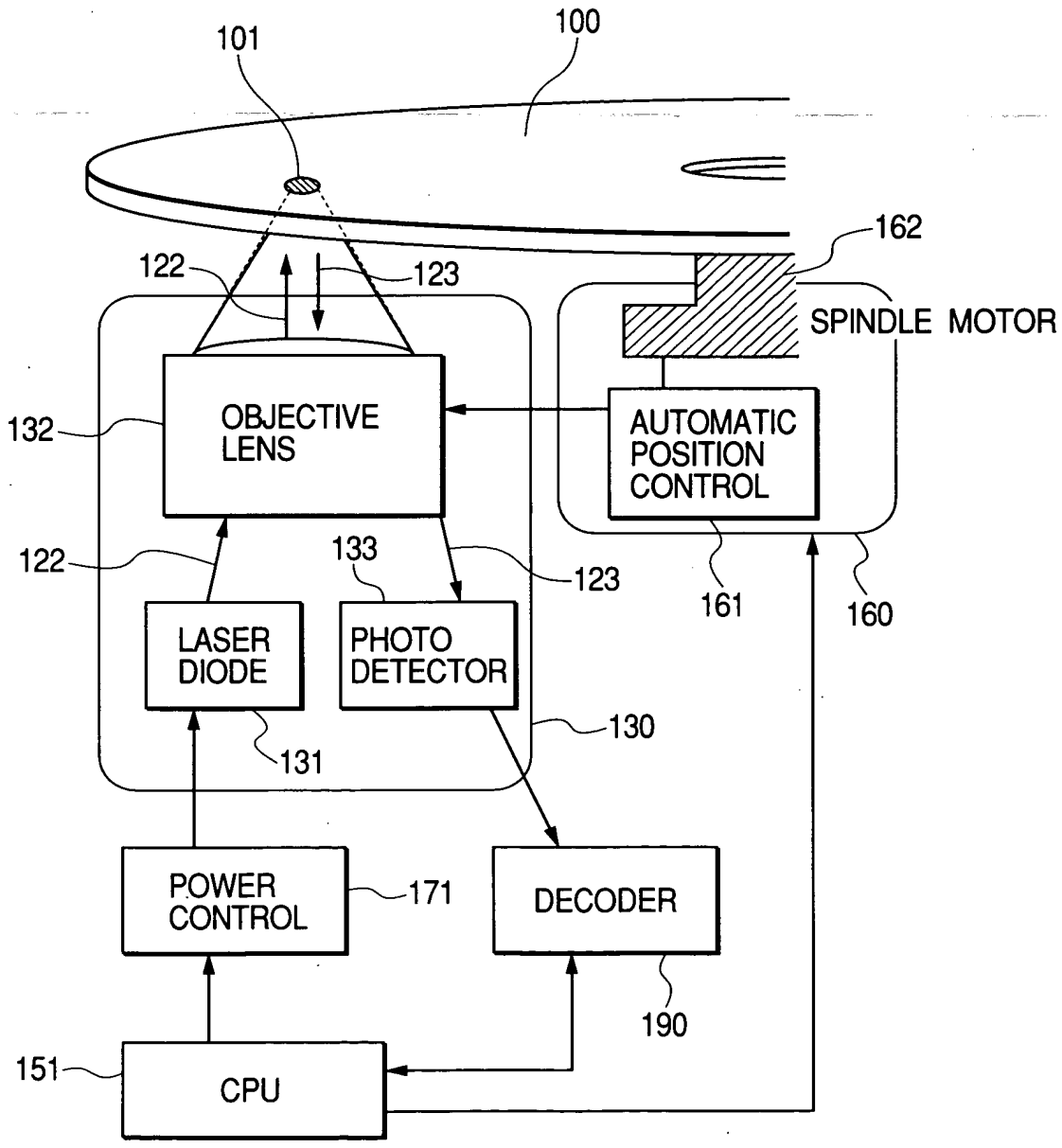


FIG. 15B

MODE	ASYMMETRY COMPENSATION TARGET	COMPENSATION TARGET (NO RESTRICTION)
ADJUST BEFORE SHIPMENT	○	×
FIELD STUDY	○	×
VERIFY	○	×
READ	○	○
READ RETRY	×	○

FIG. 16


101
100
162
122
123
SPINDLE MOTOR
OBJECTIVE LENS
132
AUTOMATIC POSITION CONTROL
122
133
123
161
160
LASER DIODE
PHOTO DETECTOR
130
131
POWER CONTROL
171
DECODER
190
151
CPU